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Article

## Residential Segregation and Unequal Access to Schools

Jaap Nieuwenhuis \* and Jiayi Xu

Department of Sociology, Zhejiang University, 310058 Hangzhou, China; E-Mails: jaap\_nieuwenhuis@zju.edu.cn (J.N.), 21922015@zju.edu.cn (J.X.)

\* Corresponding author

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### Abstract

Socio-spatial inequality and school inequality are strongly related. Where people live affects the opportunities individuals have in life, such as the opportunity to send your children to a good school. The level of urbanisation is related to the number of options people have to choose good schools, so more urbanised areas likely offer more options for good schools. However, the families that can choose good schools are likely families with high income or education levels. Data for this study come from two waves of the Taiwan Youth Project ( $N = 2,893$ ), which consists of two cohorts of students from 162 classrooms in 40 junior high schools in northern Taiwan. When school quality is proxied by socioeconomic status (SES), the results show that, in general, students from the most urbanised areas, wealthier parents, and higher-educated parents, are more likely to go to higher SES schools. However, the strongest effects are for higher income and higher-educated parents in the most urbanised areas. This suggests that in the most urbanised areas, families have the most options regarding school choice, and richer and more educated families are better able to circumvent school catchment areas, either because they can afford an address in a better catchment area or because they understand the importance of school choice.

### Keywords

catchment areas; parental socio-economic status; school quality; segregation; urbanisation

### Issue

This article is part of the issue “Vicious Circle of Segregation: Understanding the Connectedness of Spatial Inequality across Generations and Life Domains” edited by Tiit Tammur (University of Tartu, Estonia), Siiri Silm (University of Tartu, Estonia), Frank Witlox (Ghent University, Belgium), Maarten van Ham (Delft University of Technology, The Netherlands) and Madli-Johanna Maidla (University of Tartu, Estonia).

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### 1. Introduction

School quality plays a crucial role in chances for a good education. Good schools provide students with higher learning outcomes and nonmaterial resources, such as social and cultural capital to succeed in a work environment (Bourdieu, 1977; Lareau, 1987). Education is known as the most effective path to upward social mobility for disadvantaged children by creating an equitable distribution of learning outcomes (Downey & Condrón, 2016). However, educational inequality has persisted over time in many countries and been widely discussed again since the neoliberal education reforms (Alon, 2009; Tam & Jiang, 2014; Yang, Huang, & Liu, 2014). In this

study, we focus on the case of Taiwan, where educational inequality is also emphasised as a concern by several studies (L.-J. Chen, 1993; L.-J. Chen & Chen, 2009; Y. G. Chen, 2001; Mao, 2015), but is understudied when it comes to spatial processes (Nieuwenhuis, 2020; Nieuwenhuis & Hooimeijer, 2016).

School quality can be operationalised in different ways, all with their own limitations. We suggest that the idea of school quality is partly socially constructed through parental perceptions. Certain schools are perceived to be of higher quality than others and parents use their resources to ensure their child's admission to those schools. This will ultimately lead to a sorting of children from different socioeconomic backgrounds into

different schools, with schools that are perceived as high-quality having a, on average, higher socioeconomic status (SES) population than schools that are not perceived as high quality. Therefore, school quality is proxied with average school income. Schools' quality has more often been linked to the SES of its population (Condrón & Roscigno, 2003; Perry & McConney, 2010), and higher-SES schools have been shown to positively impact students' educational achievement (Nieuwenhuis, 2018; Portes & MacLeod, 1996). Schools with a higher SES population provide more social and cultural capital, which can further benefit students' achievement (Cheadle & Amato, 2011; Lareau, 1987). When higher parental SES is reflected in school expenditure, higher-SES schools can afford better teachers, activities, and facilities (Elliott, 1998; Greenwald, Hedges, & Laine, 1996; Hochschild & Scovronick, 2003), as well as enhance the teacher-student ratio (Wenglinsky, 1997). Although most public primary and secondary schools in many areas receive equal government funding (Butler & van Zanten, 2007), good schools are unequally spatially distributed (Oberti, 2007; Wilson & Bridge, 2019). Generally, more developed urban areas have more higher-SES families and more educational resources, so schools in urbanised areas have higher-SES populations and are often of better quality than in less urbanised areas (L.-J. Chen & Chen, 2009; Owens & Candipan, 2019; Parsons, Chalkley, & Jones, 2000). Thus, urban children are likely to have better access to good schools.

Also within urban areas, the distribution and access opportunities of good schools are unequal because of school segregation, which is strongly connected to residential segregation (Bernelius & Vaattovaara, 2016; Oberti, 2007; Taylor & Gorard, 2001). Many countries set school catchment areas that link the place of residence to a selection of nearby schools available to children in that area (e.g.: in the UK, see Mayet, 1996; Parsons et al., 2000; in Germany, see Noreisch, 2007; in France, see Oberti & Savina, 2019; in Australia, see Rowe & Lubienski, 2017; in China, see Wen, Xiao, & Zhang, 2017; Wu, 2012). Because of residential segregation by SES (Nieuwenhuis, Tammaru, van Ham, Hedman, & Manley, 2020), some school catchment areas are wealthier than others and consequently have schools with higher average income levels. When, as described above, perceived school quality is what attracts high-income families to certain catchment areas, a correlation between school quality and the school population's income is suggested. For example, in the US, the quality of public schools was found to be shaped by the amount of wealth in a school district (Kozol, 1991; Slavin, 1999).

Family background is considered a strong predictor of educational differentiation (Marjoribanks, 1979; Nieuwenhuis, Hooimeijer, van Dorsselaer, & Vollebergh, 2013). Studies show that parental income and education influence children's ability to do well in education (Cheadle & Amato, 2011; Lareau, 1987). Some argue that working-class parents with low income and edu-

cational levels pay less attention to school choice and long term educational strategies (Ball, 2002). Others believe that although parents of each class have the same educational expectations for children, they have vastly different abilities and economic resources to attain them (Chin & Phillips, 2004; Votruba-Drzal, 2003). High-income parents can afford houses in urban areas with better schools, and higher-educated parents may be better equipped with knowledge about good schools (Webber & Butler, 2007). Therefore, to understand the relation between parents' income and education and school quality in areas with different levels of urbanisation, we examine the interaction between urbanisation and parental SES in Taiwan. This will shed light on whether high-SES parents are better able to exploit the opportunities of urbanised areas than low-SES parents. In sum, our research question is: How are urbanisation and the interrelation between urbanisation and parental socioeconomic background related to students' differential access to schools? By studying the Taiwanese case, we include an East Asian perspective to the mostly Western-based body of literature.

## 2. Factors Shaping Access Opportunities to Good Schools

Both urbanisation (Parsons et al., 2000) and family SES (Cheadle & Amato, 2011; Marjoribanks, 1979) make differences to children's chances for good schooling, and the two factors are intertwined as family SES tends to be related to spatial residential choice (Nieuwenhuis & Hooimeijer, 2016). High-SES families tend to aggregate in urban areas where dense population and developed economies give rise to more well-paid, high-skilled jobs (Hacker, Klaesson, Pettersson, & Sjölander, 2013). Besides, due to residential sorting based on income, not only between areas of different levels of urbanisation but also within areas, the spatial distribution of households with different SES is uneven (Nieuwenhuis et al., 2020; Oberti & Savina, 2019). Much of the existing literature investigates access opportunities to good schools in terms of urbanisation and family SES separately, but their combined impact lacks sufficient exploration. We will, therefore, review the existing research from each of these two perspectives first and then propose our hypotheses.

### 2.1. Urbanisation and Residential Segregation Causing Educational Inequality

Education is socio-geographically unequal because economically developed urban areas tend to have more resources for infrastructure like schools (Logan, Minca, & Adar, 2012; Roscigno, Tomaskovic-Devey, & Crowley, 2006). Take the US as an example, poorly performing schools are located in the most disadvantaged rural areas that suffer high poverty rates (Lichter & Brown, 2011; Lichter, Cornwell, & Eggebeen, 1993). Noreisch (2007)

reported that in Germany, there are far more school options in urban areas than in rural areas. In some places (e.g., in Taiwan), the central government provides disadvantaged public schools with subsidies according to a uniform national standard, but studies show that educational funds are still unequal (L.-J. Chen, 1993; L.-J. Chen & Chen, 2013). Also, many countries allow private schools to encourage competition for quality development in public schools (Broccolichi & van Zanten, 2000; Lubienski, 2005; Rowe & Lubienski, 2017). These private schools reinforce the educationally advantaged position of urbanised areas. For example, in Chile, private schools located closer to the city centre have better teachers, student-teacher ratio, and educational test results than more peripherally located schools (De la Fuente, Rojas, Salado, Carrasco, & Neutens, 2013). In sum, urbanised areas have a greater variety of schools both in quality and quantity than less urbanised areas, suggesting between-area inequality in opportunities for good schooling.

Schools are also unequally distributed within urbanised areas. Generally, the best performing and most attractive schools are concentrated in the most advantaged urban neighbourhoods, while the less developed schools are located in mostly working-class neighbourhoods (Oberti, 2007). This is partly because high- and low-income families cluster in separate neighbourhoods within the city, which appears as economic residential segregation (Nieuwenhuis et al., 2020). Residential segregation and school segregation are thought to be mutually reinforcing factors (Bernelius & Vaattovaara, 2016; Frankenberg, 2013; Taylor & Gorard, 2001; Waslander & Thrupp, 1995). High-performing schools are likely to be located in affluent neighbourhoods (Oberti & Savina, 2019), where there are school catchment areas with higher levels of income (Rowe & Lubienski, 2017). The amount of wealth in a school catchment area shapes its school's quality (Kozol, 1991; Slavin, 1999). Consequently, the housing market around popular schools will be hot and thus hard for low-income parents to afford, further restraining their school choices. The more wealthy parents try to move into areas with desirable schools, the more expensive popular areas become (Butler & van Zanten, 2007; Wen et al., 2017), resulting in expensive gentrified areas only available to a wealthy few (Butler, Hamnett, & Ramsden, 2013; Wilson & Bridge, 2019). So this actually forms a vicious circle where wealthy parents cluster in wealthy catchment areas of popular schools and make these schools and areas even more attractive and expensive (Bernelius & Vilka, 2019).

## 2.2. Parental SES and School Choice Causing Educational Inequality

High-SES parents can evade school catchment area restrictions by moving into other catchment areas with better schools or by some illicit means like

using false addresses (Boterman, 2019; McGinn & Ben-Porath, 2014). Considering parents' school choosing needs, many countries adopt school choice policies that allow choosing schools across catchment areas, with the hope to promote school quality through competition (Hadderman, 2002; McGinn & Ben-Porath, 2014). However, such policies have been controversially debated since their implementation. Some argue that they can improve the quality and equity of education, especially by allowing disadvantaged parents to choose schools across districts (Manno, Finn, Chester, Bierlein, & Gregg, 1998; Viteritti, 2003), but more studies show that school choice policy exacerbates educational inequality because parents of different classes do not have the same ability to choose schools (Cheng, 2002). Parents who have the ability of school choice are highly educated with occupational prestige, compared to lower SES families forced to accept the school catchment assignment (Echols & Willms, 1992; Willms & Echols, 1993). Thus, students from high-SES families may benefit more from this education market of school choice (Robert, 2010).

Attitudes towards education also matter towards school choice, albeit restricted by available resources. Middle-class parents are found to regard education as a negotiable system while working-class parents just accept the school arrangement (Webber & Butler, 2007; Willis, 1977). Lower-class parents may not be aware of the benefits of education, as they have not benefitted much from education themselves. However, Chin and Phillips (2004) argue that parents of different SES all have high educational expectations for children and apply similar parenting strategies, but disadvantaged families are restricted by a lack of resources, which means it is not attitudes but rather attitudes in the context of the range of available options that matters (Boterman, 2019). In summary, different attitudes and abilities between parents of different SES affect children's chances of good schooling.

## 2.3. School Access in the Taiwanese Context

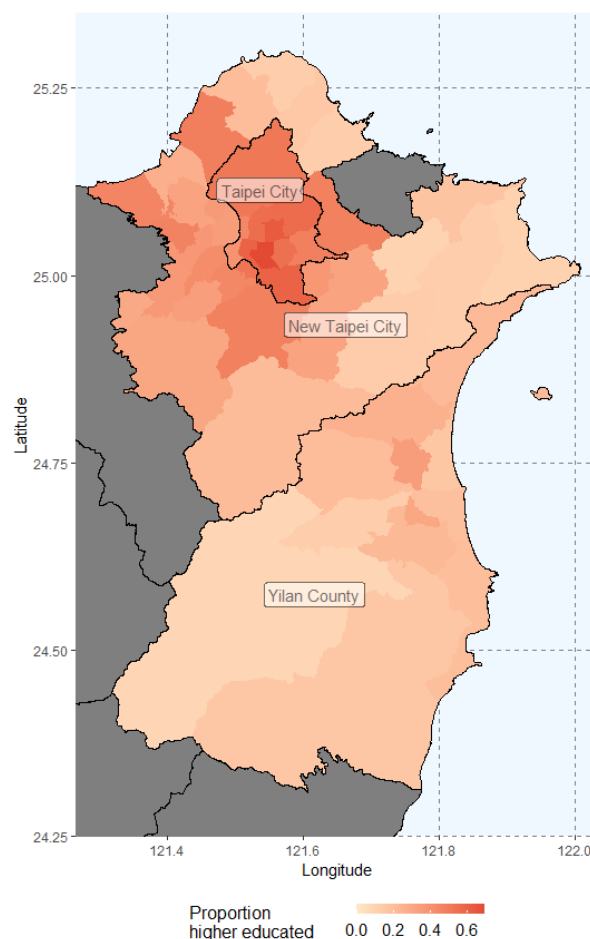
The education system of Taiwan provides a crucial case to explore how urbanisation and parental SES act together predicting unequal school access opportunities. Taiwan has implemented a nine-year, centrally controlled education since 1968. With compulsory education until middle school, the government aims to ensure equal opportunities (Ministry of Education, 2020b). Although from the late 1980s to the early 1990s, Taiwan relaxed central government control and enhanced the local autonomy of education under the influence of neo-liberal ideology (Mao, 2015). Public middle schools still dominate, with recent statistics showing that 98.2% of middle schools are public (Ministry of Education, 2020a). Public schools are mainly financed by local governments (L.-J. Chen, 2006). The central government only provides financial subsidies if local educational funds are not up to the national standards, to ensure equal conditions for public

middle schools in all regions. Such a system would theoretically ensure similar funding and qualities among public schools. Nevertheless, studies show that the disparity in economic development across Taiwan leads to a large financial inequality in education (L.-J. Chen, 2006). Local educational spending in urbanised areas is much higher than in less urbanised areas (L.-J. Chen & Chen, 2013).

In Taiwan, public middle schools that students attend are determined by the system of catchment areas set up by administrative education authorities (Mao, 2015). Students generally go to the nearest middle school according to their family's residence in the catchment area. But under the pressure of the high school entrance exam, some parents believe that only the informally ranked "superstar schools"—junior high schools with a high percentage of graduates gaining admission to prestigious public senior high schools (Mao, 2015)—will better prepare their children for the entrance exams of elite high schools. Contrasting with some Western cases, these prestigious public schools are generally perceived as higher status schools than private schools (Chu & Yeh, 1995), which is comparable to the situation in Japan (Aizawa, 2016). So, if there are no such "superstar schools" in a given school catchment area, some may gain access to schools across the catchment boundary by changing their home address (Mao, 2015). As a result, the access opportunity to middle schools of various qualities is unequal in reality. The differences in school popularity lead to fierce competition to gain access to perceived high-quality schools. Such competition requires that parents spend a great deal of energy and resources on choosing schools and deciding where to live, which means middle-class parents with more available resources are more likely to win. This inequality of access to schools is more severe in densely populated areas than in less populated areas (Chang, 2000), from which we can infer that more urbanised areas with large populations have more access to good schools but also more severe competition for entrance.

The unequal access to schooling is reflected in the distribution of SES in our study area (i.e., northern Taiwan): Figure 1 shows that more urbanised centres such as Taipei City contain higher shares of highly educated individuals and shows a variation with urbanised areas as well. Much of this image can be explained by urban areas being the areas where higher-paying jobs cluster, requiring highly educated people, but the image also aligns with the idea that in terms of schooling, some areas are more attractive than others, potentially causing the spatial variation of high-SES individuals. When comparing educational and occupational segregation in our study area with other areas in Taiwan (Table 1), it shows that segregation is on the lower end compared to the rest of Taiwan. In the case of Taiwan, most of the variation in SES is within, rather than between districts. Taipei is comparable to a city like Tokyo in its low level of urban segregation (Maloutas & Fujita, 2012). The relatively low levels of segregation can be related to Taiwan's relative-

ly low income inequality compared to the region. With a disposable household income Gini index of 31.1 in 2010, income inequality is lower than in Mainland China (42.8), Hong Kong (40.7) and Singapore (39.3), and comparable to Japan (31.8) and South Korea (31.4; see Solt, 2020). We aim to examine how, in a situation of relatively low segregation and inequality, families seek educational distinction for their children.



**Figure 1.** Proportion of higher-educated individuals in northern Taiwan, by township, city, and district. Notes: The map shows the proportions of individuals aged 15 years and over with junior college, university, or higher education in 2010. The spatial scale is townships/cities/districts, which are nested in Taipei City, New Taipei City (which roughly corresponds to Taipei County in our data, which was renamed New Taipei City in 2010), and Yilan County. Source of data: 2010 Population and Housing Census (DGBAS, 2010).

#### 2.4. Hypotheses

Previous studies have pointed out that urbanisation and family SES both affect access opportunities to schools. Because high-income schools and high-SES families both cluster in urbanised areas, parents of higher socioeconomic backgrounds have better school

**Table 1.** Residential segregation by education and occupation in counties and cities.

	$H^R$ education	$R^R$ education	$H^R$ occupation	$R^R$ occupation
Hualien County	.054	.066	.031	.038
Yunlin County	.044	.056	.028	.035
Taitung County	.044	.055	.022	.025
Chiayi City/County	.043	.053	.044	.055
Penghu County	.035	.045	.019	.025
Pingtung County	.033	.040	.034	.042
Miaoli County	.033	.040	.030	.036
Tainan City	.031	.039	.034	.042
Nantou County	.029	.035	.019	.022
Taichung City	.028	.035	.033	.041
Hsinchu City/County	.027	.036	.036	.043
Changhua County	.023	.028	.028	.035
Kaohsiung City	.022	.027	.028	.033
Yilan County*	.021	.026	.027	.033
Taipei City*	.019	.027	.020	.024
New Taipei City*	.019	.023	.017	.020
Taoyuan County	.014	.018	.017	.020
Kinmen County	.010	.012	.017	.020
Keelung City	.004	.005	.006	.007
Lienchiang County	.000	.001	.009	.012

Notes: Segregation indices  $H^R$  and  $R^R$  stand for the rank-order information theory index and the rank-order variance ratio index, respectively (for more specific descriptions of these measures see Reardon, 2011). Both can be interpreted as proportions of the variation in education and occupation that lies between rather than within townships/cities/districts. Educational segregation is based on four categories: “elementary and lower,” “junior high,” “senior high and vocational,” and “junior college, university and higher.” Occupational segregation is based on nine categories: “legislators, senior officials and managers,” “professionals,” “technicians and associate professionals,” “clerical support workers,” “service and sales workers,” “skilled agricultural, forestry and fishery workers,” “craft and related trades workers,” “plant and machine operators, and assemblers,” and “elementary labourers.” The segregation measures for education and occupation use the first and sixth polynomial, respectively. The list is ordered from highest to lowest segregation based on  $H^R$  education. Source of data: 2010 Population and Housing Census (DGBAS, 2010). \* Yilan County, Taipei City, and New Taipei City (Taipei County) are the sample areas.

choices. Based on the previously established connection between these two factors, we formulated the following two hypotheses:

- Hypothesis 1: Students in more urbanised areas have access to (a) higher-income schools and (b) more variation in school average income levels than students in less urbanised areas.
- Hypothesis 2: In more urbanised areas, students with higher family SES have access to higher-income schools than students with lower family SES, but not in less urbanised areas.

### 3. Data and Methods

#### 3.1. Data

We used the Taiwan Youth Project, a panel dataset of students and parents from Northern Taiwan, collected since 2000. The original sample consisted of 5,541 students from a 7th and 9th-grade cohort, aged around 13 and 15, respectively. Respondents were sampled from 162 classrooms within 40 schools, within three regions (Taipei City, Taipei County, and Yilan County). We used both student-

and parent-reported information, from survey waves 1 and 4 (in wave 4, students were in the first and final year of high school for the younger and older cohort, respectively). The final sample with all relevant information was 2,893.

#### 3.2. Measurements

Average school income was measured using parental income from survey wave 4. For the older cohort, household income was measured as a parent-reported continuous variable (0 to 155 in NT\$1,000). For the younger cohort, the measure consists of a student-reported categorical variable. We used the middle of the NT\$10,000 categories as our value. The average school income was measured by taking the average household income for each of the 146 schools students attended in wave 4. Descriptive statistics are available in Table 2.

The level of urbanisation of the respondents' place of residence was measured with the following categories: core city, general city, emerging town, and general and ageing township. This classification was specifically designed to best capture urbanisation in Taiwan (Hou, Tu, Liao, Yung, & Chang, 2008). The classification



**Table 2.** Descriptive statistics (N = 2,893).

Variable	Mean	SD	Min.	Max.
Average school income	57.48	19.01	15	125
Household income	59.66	34.31	0	155
Parental education	3.45	1.63	1	7
Years lived in the neighbourhood	8.73	7.34	0	18
	Prop.			
Urbanisation: Core city	.48			
—General city	.31			
—Emerging town	.12			
—General and ageing township	.08			
Female	.50			
9th-grade cohort	.44			
Ethnicity: Minnan	.78			
—Hakka	.07			
—Mainland	.13			
—Aboriginal/other	.02			

was calculated using Ward's minimum variance method, including six categories that capture urbanisation in Taiwan: the percentage of service industry population, the percentage of industry population, the percentage of 15 to 64 years old population, the percentage of above 65 years old, the percentage of the above population holding a college degree, and population density (Hou et al., 2008).

Household income was measured in wave 1 as a parent-reported continuous variable (0 to 155 in NT\$1,000). In the few cases parent-reported income was missing, we substituted with a categorical student-reported household income. We used the middle of the NT\$10,000 categories as our value.

Parental education was measured continuously as parents' highest level of education in the following order: elementary school, middle school, vocational high school, academic high school, junior college, university, and graduate school.

We included four control variables: sex (0 = male; 1 = female) and cohort (0 = 7th grade; 1 = 9th grade). Ethnicity has been shown to play a role in education in Taiwan, where especially Mainlanders have an advantage over other groups (Chiang & Park, 2015; Jao & McKeever, 2006). Ethnicity was measured as father's ethnic background (1 = Minnan; 2 = Hakka; 3 = Mainlander; 4 = Aboriginal/other). Finally, because the residential environment might be more important when students have lived there longer (Nieuwenhuis, Yu, Branje, Meeus, & Hooimeijer, 2016), we included the years someone lived in his/her neighbourhood in wave 4.

### 3.3. Analyses

To test our hypotheses, we examined the relationship between urbanisation, parental education, household income in wave 1 (age 13/15) and average

school income in wave 4 (age 16/18) using regression analysis. Because respondents who attend the same school are not independent of each other, we clustered standard errors in schools, to avoid underestimating p-values. We present three models, the first including all relevant covariates, and the second and third including an interaction between urbanisation and household income and parental education, respectively. Additionally, we calculated the marginal effects of parental education and household income for the different levels of urbanisation.

To calculate average school income, we only used schools that had 10 or more students from the sample enrolled to ensure the precision of the estimate. Additional robustness checks using only schools with 20 or more students show the same results (available on request), further indicating good precision. Because of this limit, we had to omit 880 respondents from the analyses. Further attrition between waves reduced our sample from the original 5,541 to 2,893. To test whether attrition could affect our outcomes, we performed several t-tests to examine whether the probability of data *missingness* is associated with school average income. We test how different the used sample is from the sample with missing values, on several key variables (Allison, 2002). The tests showed that parental education ( $t = .54$ ,  $df = 5,403$ ,  $p = .591$ ) and urbanisation ( $t = -1.09$ ,  $df = 5,539$ ,  $p = .274$ ) are missing at random. Respondents coming from households with lower household income are more likely to be missing ( $t = 3.24$ ,  $df = 5,368$ ,  $p = .001$ ). The higher attrition from lower-income households could potentially influence our results.

## 4. Results

Table 3 shows the descriptive results of average income levels in schools by level of urbanisation. More urbanised

**Table 3.** Descriptive statistics of average school income by level of urbanisation.

	Mean	SD	Min.	Max.
Core city	63.11	12.45	43.74	87.95
General city	59.65	9.44	48.40	77.22
Emerging town	46.87	4.80	39.59	52.99
General and aging township	42.93	5.99	34.00	49.01

areas have higher average and maximum levels of school income and also a wider range of school income than less urbanised areas, in line with hypothesis 1. Next, we tested how urbanisation, family SES, and average school income are related (Table 4). Model 1 also shows that students from less urbanised areas are more likely to attend lower-income schools, which is in line with hypothesis 1a and the descriptive results from Table 3. Besides, children from higher-educated and higher-income parents are more likely to attend higher-income schools. Models 2 and 3 present the interaction between urbanisation and household income and parental education, respectively. The models show, in line with hypothesis 2, that the relationship between parental income and education and school income levels is stronger for children in the areas with high levels of urbanisation

(core and general city), and weaker in emerging towns and townships. The likelihood ratio tests show that both models are an improvement over the models without interactions. Marginal effects show that both household income and parental education only have a significant effect in the most urbanised areas (Income: core city:  $b = .11$ ;  $s.e. = .02$ ;  $p < .001$ ; general city:  $b = .06$ ,  $s.e. = .02$ ,  $p = .002$ ; emerging town:  $b = .04$ ,  $s.e. = .02$ ,  $p = .116$ ; township:  $b = .04$ ,  $s.e. = .04$ ,  $p = .276$ ; Education: core city:  $b = 2.90$ ,  $s.e. = .48$ ,  $p < .001$ ; general city:  $b = 1.59$ ,  $s.e. = .57$ ,  $p = .006$ ; emerging town:  $b = -1.19$ ,  $s.e. = .50$ ,  $p = .019$ , township:  $b = -.52$ ,  $s.e. = .73$ ,  $p = .475$ ). The time during which respondents lived in their neighbourhood did not change the relationship between urbanisation, parental SES, and attending higher-income schools. Finally, control variables gender,

**Table 4.** Regression results for school income level ( $N = 2,893$ ).

	Model 1			Model 2			Model 3		
	B	SE	p	B	SE	p	B	SE	p
Urbanisation (ref. Core city)									
(2) General city	-3.47	2.07	.095	-.30	2.54	.905	1.32	3.11	.672
(3) Emerging town	-9.15	2.32	<.001	-5.08	2.84	.076	-3.99	3.22	.218
(4) General and aging township	-14.52	2.71	<.001	-10.75	3.22	.001	-7.52	3.80	.049
Household income (in NT\$1,000)	.08	.01	<.001	.11	.02	<.001	.08	.01	<.001
Parental education	2.17	.35	<.001	2.12	.34	<.001	2.90	.48	<.001
Interaction household income with urbanisation									
(2)				-.05	.03	.058			
(3)				-.08	.03	.015			
(4)				-.07	.04	.085			
Interaction parental education with urbanisation									
(2)							-1.31	.69	.059
(3)							-1.70	.72	.019
(4)							-2.37	.92	.011
Female	1.69	1.37	.220	1.63	1.36	.232	1.62	1.35	.232
9th grade cohort	3.18	3.68	.389	3.15	3.66	.391	2.94	3.67	.425
Ethnicity (ref. Minnan)									
—Hakka	.60	1.38	.665	.64	1.38	.643	.62	1.37	.649
—Mainland	2.44	1.20	.044	2.39	1.20	.048	2.28	1.19	.058
—Aboriginal/other	-.93	2.24	.678	-.98	2.22	.659	-.99	2.18	.652
Years lived in the neighborhood	.26	.14	.071	.26	.14	.072	.27	.14	.060
Intercept	43.53	2.72	<.001	41.91	2.81	<.001	40.99	2.96	<.001
$R^2$	.2276			.2305			.2317		
Likelihood ratio test with Model 1 ( $\chi^2$ (df))				10.87 (3)	.012	15.45 (3)	.002		



cohort, and ethnicity did not play a role in predicting average income in schools. Only Mainlanders seemed to end up on higher-income schools, however, because the significance level hovered around  $p = .05$ , depending on the model, this evidence is very weak.

## 5. Conclusion

School inequality has a crucial influence on educational outcomes and life opportunities. This article aims to identify how urbanisation and family SES are related to children's access opportunities to good schools. Our results show that both factors impact access to schools and that the two are intertwined. Students with higher family SES backgrounds from more urbanised areas have more opportunities to access higher-income schools. But this relation between family SES and school inequality is only prominent in the most urbanised areas and does not appear in less urbanised areas. It suggests that in the most urbanised areas, higher income and higher educated parents enjoy more school choices, like high-income public schools or private schools. They may have more economic resources and knowledge to choose good schools despite school catchment area limitations because they can either afford addresses in an affluent catchment with high-quality schools or put more effort into children's educational planning and school choice. However, when it comes to less urbanised areas like towns or townships, schools are generally poorer and fewer, so the relation between parental SES and school income level is not present, which underlines the socio-spatial inequality of school distribution. This also adds to the understanding that school quality is a pathway through which residential segregation can reproduce educational inequality (Galster, 2011; Nieuwenhuis & Hooimeijer, 2016; Nieuwenhuis, Hooimeijer, & Meeus, 2015).

The Taiwanese case in this article verifies the relation between socio-spatial inequality and school inequality, and the relation between family SES and school inequality in previous studies. Furthermore, we extend this literature by demonstrating how urbanisation and family SES interact together when predicting children's school access opportunities. When a place is more urbanised, there will be more high-income jobs and economic resources, which will attract higher-educated parents. On the other hand, such places will be difficult to afford for low-SES parents, thus fostering residential segregation. Together with school segregation, such socio-spatial inequality exacerbates educational inequality. Because levels of residential segregation in our study areas are lower than in many other counties and cities in Taiwan, school quality may be more stratified by family SES in other areas. Placing Taiwan in the East Asian region is more difficult: Taiwan's and South Korea's educational inequality are decreasing, Japan's and culturally similar Mainland China's educational inequality are increasing (Hannum, Ishida, Park, & Tam, 2019). How the differ-

ences in residential inequality in these regions relate to changes in the educational climate still needs more rigorous and comparative study.

We identified three limitations to this study which can contribute to the development of future studies on this topic. First, it is unclear if our findings are generalisable to areas with free school choice. In many European countries, school choice policy has been implemented, but its impact on educational equity is controversial (Cheng, 2002; Viteritti, 2003; Willms & Echols, 1993). In the United States, many publicly funded but privately managed charter schools have no eligibility restrictions. While charter schools give some minority students extra school choices, these schools may draw away funding from public schools, but have uncertain educational outcomes (Bifulco & Ladd, 2006) and even increased school segregation (Rotberg, 2019). The effect of these school choice policies on educational equity also depends on the local education system and the perception of parents of public vs. private schools (the former being considered higher status in Taiwan, but not necessarily in other places), so more research is needed for accurate comparisons. It is reasonable to speculate that high-SES parents will always be able to access better schools by calling on the economic and cultural resources they have. In cases with school district restrictions, they can purchase houses in better school catchment areas to qualify for admission. With a free school choice policy, they can choose more expensive and competitive schools, because they can afford the cost of commuting long distances to other school districts. Besides, higher SES parents can afford supplementary education, even further exacerbating educational stratification. While low-SES parents, on the one hand, may be able to avoid bad schools within their catchment when there are no school district restrictions on the other hand, they may still only be able to afford the closest school regardless of its quality, as they have fewer resources for commuting. Furthermore, they may not be as aware as higher-SES parents of the importance of and diversity in school quality. Thus, whether the effects of parental SES and urbanisation are different under the two, school choice systems may await future comparative studies.

Second, we only had access to data about average parental income for schools, which we used as a proxy for school quality. With this proxy, we refer to the social constructive process describing how parental perceptions of school quality is reflected through wealthier parents being able to put more resources into getting into these perceived good schools, resulting in a clustering of a higher-income population in perceived higher-quality schools. Of course, this proxy is not perfect, and future studies may improve on this by using more comprehensive measures of school wealth and quality, which could include school funding and donations, teacher-student ratio, or measures for teacher quality.

Third, the informed assumption of a positive correlation between school wealth and quality still needs

further examination. What are the mechanisms and conditions for this relation? High-SES households can potentially bring in more donations that contribute to school quality, as well as social and cultural capital that help students' development and chances. Future research into this topic may want to study indicators of school wealth and school quality simultaneously, to understand more specifically what parents base their school decisions on.

In conclusion, even when school populations are mostly reflections of the catchment area population, it is the high-SES parents who are best able to avoid catchment areas. Taiwan's uniform public school funding and catchment area limitations still leave room for unequal school access opportunities. For educational policymakers, this article, combined with those about school choice policies, suggest that the educational outcomes of school choice policy and catchment areas are not clear-cut, and are strongly linked to geography. Where people live, both in terms of between different cities, as within cities, is associated with the opportunity structure faced by parents, with some parents being better able to deal with this structure than others.

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#### Conflict of Interests

The authors declare no conflict of interests.

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### About the Authors



**Jaap Nieuwenhuis** is Associate Professor at the Department of Sociology at Zhejiang University, China. His major research interests include understanding whether and how neighbourhood and school characteristics influence adolescents' developmental and educational outcomes. Currently, he is working on social networks and social capital in school contexts.



**Jiayi Xu** is a master's student at the Department of Sociology at Zhejiang University, China. Her main research interests are political sociology and urban sociology. Her undergraduate thesis was about online social movements. Now she is working on gardening history in urban cities and hopes to write about professional gardeners and landscape designers.